
**Information technology — Biometric data
interchange formats —**

**Part 5:
Face image data**

**AMENDMENT 1: Conditions for taking
photographs for face image data**

*Technologies de l'information — Formats d'échange de données
biométriques —*

Partie 5: Données d'image de la face

*AMENDEMENT 1: Conditions de prise de vues pour données d'image
de la face*

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Foreword

ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission) form the specialized system for worldwide standardization. National bodies that are members of ISO or IEC participate in the development of International Standards through technical committees established by the respective organization to deal with particular fields of technical activity. ISO and IEC technical committees collaborate in fields of mutual interest. Other international organizations, governmental and non-governmental, in liaison with ISO and IEC, also take part in the work. In the field of information technology, ISO and IEC have established a joint technical committee, ISO/IEC JTC 1.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of the joint technical committee is to prepare International Standards. Draft International Standards adopted by the joint technical committee are circulated to national bodies for voting. Publication as an International Standard requires approval by at least 75 % of the national bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO and IEC shall not be held responsible for identifying any or all such patent rights.

Amendment 1 to ISO/IEC 19794-5:2005 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 37, *Biometrics*.

Introduction

This part of ISO/IEC 19794 is intended to provide a Face Image Format for face recognition applications requiring the exchange of face image data. Its typical applications include:

- a) Human examination of high resolution facial images;
- b) Human verification of identity;
- c) Computer automated face identification;
- d) Computer automated face verification.

To enable applications on a wide variety of devices, including devices that have limited data storage, and to improve face recognition accuracy, ISO/IEC 19794-5 specifies not only a data format, but also scene constraints (lighting, pose, expression, etc.), photographic properties (positioning, camera focus, etc.), and digital image attributes (image resolution, image size, etc.).

This part of ISO/IEC 19794 includes an informative annex, Annex A, entitled “Best practices for Face Images”. Although Annex A provides guidance on topics such as subject pose and expression, image compression ratio, color, geometric distortion, spatial resolution and head size, it does not guide photographers or the designers and operators of photo booths concerning how, for example, they might arrange lighting and reflective surfaces relative to the camera and subject. It also doesn’t provide specific advice on the acceptable amount of variation in illumination across the face, on how to avoid shadows on the face or background, or on a user interface that would ensure proper head positioning.

This Amendment is Annex B to ISO/IEC 19794-5 and is entitled “Conditions for taking photographs for face image data”. It provides expert guidance for the design of photographic studios, photo booths and registration offices and, as such, it supplements the information provided in this Part of ISO/IEC 19794. It also provides guidance on printing quality and on scanning printed face photographs.

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Part 5: Face image data

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Add the following Annex after Annex A.

Annex B

(informative)

Conditions for taking photographs for face image data

B.1 Scope

The purpose of this annex is to provide expert guidance (i.e., best practices) for the photography of faces, especially when the resulting images are to be used for purposes of identification, either by automated face recognition systems or by human viewers. This guidance is intended for owners and operators of photography studios, photo stores and other organizations producing or requiring either conventional printed photographs or digital images of faces that may be used in applications for passports, visas, or other identification documents and when those images are required to conform to the frontal image types of this part of ISO/IEC 19794. This guidance is also intended for the designers and operators of photo booths, if those booths are required to provide face images conforming to the specifications of this standard. This annex may also be appropriate source material to application developers, application profile standard developers, or others making more general use of this standard.

There are many factors that affect face recognition system performance, including the individual's appearance, such as his or her facial characteristics, hair style, and accessories, and the acquisition conditions, such as the camera's field-of-view, focus, depth-of-field, background, and lighting. The acquisition conditions have, potentially, a greater influence on face recognition accuracy than the individual's appearance and, of course, are controllable by the preparer of the face images.

This annex provides recommendations for acquiring two-dimensional (2D) face images directly with an analogue, digital, or video camera, as well as for image data acquired through traditional photo printing and digital scanning. [The acquisition of three-dimensional (3D) images is out of the scope of this annex.]

This annex may also be appropriate source material for application developers, application profile standard developers, or others making more general use of this standard.

B.2 Photography recommendations

This clause provides recommendations for photographing (acquiring) face images in a portrait studio, photo store, photo booth, registration office, or other facility. Guidance concerning the positioning of the subject and camera is provided, as well as several examples of alternative lighting arrangements. The intent of this guidance is to ensure that the subject's face is properly positioned and uniformly illuminated, thereby producing images that are compliant with this International Standard and are without shadows or hot spots on the face or excessive glare in eyeglasses.

B.2.1 Recommendations for a photo studio or store

A photo studio or a photo store is typically a professionally operated facility, equipped with an analogue or digital camera, multiple adjustable light sources, a suitable background or backdrop cloth, and subject positioning apparatus designed to obtain high quality portraits. This section provides expert guidance for the owners and operators of such facilities when they must produce photographs compliant with the requirements of this standard.

B.2.1.1 Recommended positioning and distance between camera and subject

The following recommendations concern the positioning of the subject and the camera.

- The camera-to-subject distance should be within the range of 1.2 to 2.5 m. Arranging the lighting without creating shadows will likely be difficult if the camera is placed any closer to the subject.
- Proper focus and depth-of-field will be assured by pre-focusing the lens at the distance of the subject's eyes and by selecting an appropriate aperture (F-stop) to ensure a depth-of-field of at least 10 centimetres, or approximately the distance from a subject's nose to ears. The depth-of-field of a lens is dependent upon its focal length, its effective aperture, and the focus distance. Point sources which are closer or farther than the distance at which a lens is well focused will be blurred, with the extent of the blur described by a "circle of confusion." If the maximum diameter of the circle of confusion is limited by, for example, the spacing between adjacent pixels in a CCD image sensor, the front and rear distances from the plane of optimum focus that produce acceptably focused images can be determined. The sum of these front and rear distances is the depth-of-field (D_{DoF}).

$$D_{DoF} = D_{front} + D_{rear}$$

$$D_{front} = \frac{cFs(s-f)}{f^2 + cF(s-f)}$$

$$D_{rear} = \frac{cFs(s-f)}{f^2 - cF(s-f)}$$

where :

D_{front} = the front focal distance, the distance from the plane of focus

to the plane closest to the lens that is still in acceptable focus,

D_{rear} = the rear focal distance, the distance from the plane of

focus to the plane farthest from the lens that is still in acceptable focus,

c = the diameter of the circle of confusion,

s = the distance from the lens to the object plane (subject's face), and

$F = f/a$ is the F - stop, the lens focal length f divided by the effective lens aperture a

Figure B.1 illustrates these dimensions.

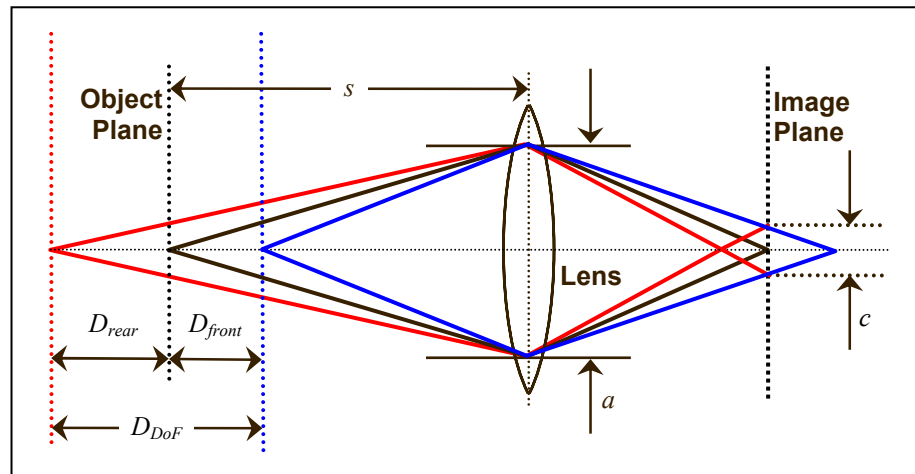


Figure B.1 — Dimensions for depth-of-field calculations

- The optimum height of the camera is at the subject's eye-level. Height adjustment can be done by either using a height-adjustable stool or adjusting the tripod's height.
- The subject should be instructed to look directly at the camera and to keep his or her head erect and shoulders square to the camera. The rotation of the head should conform to the requirements of 7.2.2.

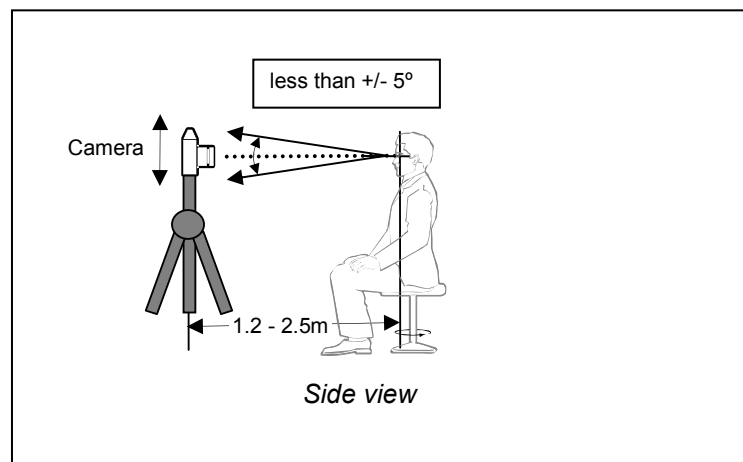


Figure B.2 — Preferred distance and alignment of camera and subject

B.2.1.2 Example of exposure metering at various spots on a subject

The figure below illustrates exposure value (EV) measurement at four spots on a subject's face, namely the left and right cheeks, forehead, and chin. The measurements may be made by placing an incident light meter at the position of a subject's face and pointing the meter towards the camera. The four readings should be within 1 EV of one another. If they are not within 1 EV, the lights should be repositioned more symmetrically about the subject-to-camera line.

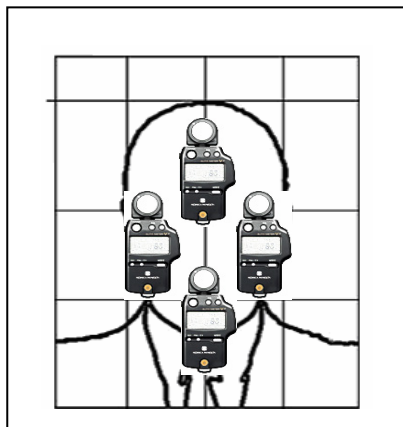


Figure B.3 — Positions of incident light meter for exposure value measurement

EV is the value given to any combination of shutter speed and aperture (F-stop) that results in the same exposure. By definition, an EV value of 0 corresponds to a shutter speed of 1 second and an aperture of F1.0, for a film speed or equivalent image sensor sensitivity of ISO 100. EV is defined by the following equation:

$$EV = \log_2 \left(\frac{F^2}{T} \right) = 2 \log_2(F) - \log_2(T),$$

where F is the F-stop setting and T is the exposure time. A change of 1 EV corresponds to a one F-stop aperture increase or decrease or a halving or doubling of the exposure time.

B.2.1.3 Example configurations for a photo studio or store

Described below are three examples of lighting and subject and camera positioning that are applicable to photographic studio businesses, as well as for some photofinishers that might offer identification photographs, in addition to their main business of material sales and film developing and printing. Example 1 is a single-light arrangement in which the placement of a panel of reflective material is used to provide more balanced lighting. Example 2 is a two-light arrangement with a lower reflective panel providing illumination to the region under a subject's chin. Example 3 is the same as Example 2, but with a third light behind the subject to eliminate shadows on the background material. Several recommendations for camera and subject positioning are also provided below.

B.2.1.3.1 Example 1: Proper lighting arrangement with a single light

In this arrangement, illustrated in Figure B.4, a single light and multiple reflector panels are employed to illuminate the subject's face uniformly. The light, shown with a lamp reflector, should be placed approximately 35 degrees above the line between the camera and the subject and be directed toward the subject's face at a horizontal angle of less than 45 degrees from the line. A reflector panel should be placed on the subject's opposite side to prevent shadows on the face. As an option, an additional reflector may be placed below and in front of the subject's face to illuminate the area around the chin.

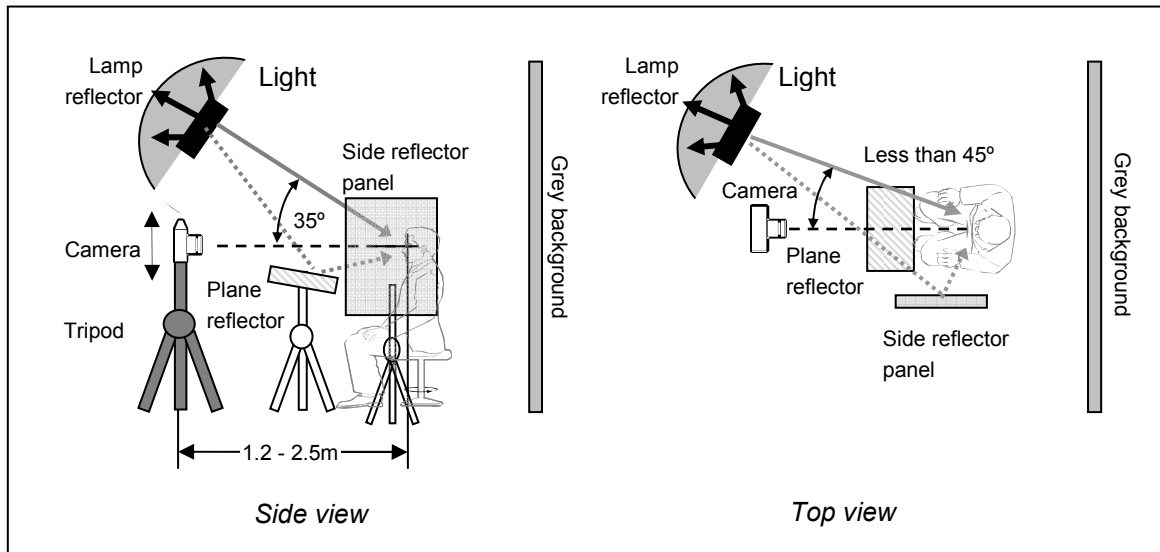


Figure B.4 — Lighting arrangement for a photo studio with a single front light

B.2.1.3.2 Example 2: Proper lighting with dual lights

In the second example illustrated in Figure B.5, two lights are employed. The lights, shown with lamp reflectors, should be placed approximately 35 degrees above the line between the camera lens and the subject. Both lights should be placed within 45 degrees of the line between the camera lens and the subject. Such an arrangement softens the edge of shadows and makes the lighting on the subject more even. The optional plane reflector in front of the subject supplies additional light around and below the subject's chin.

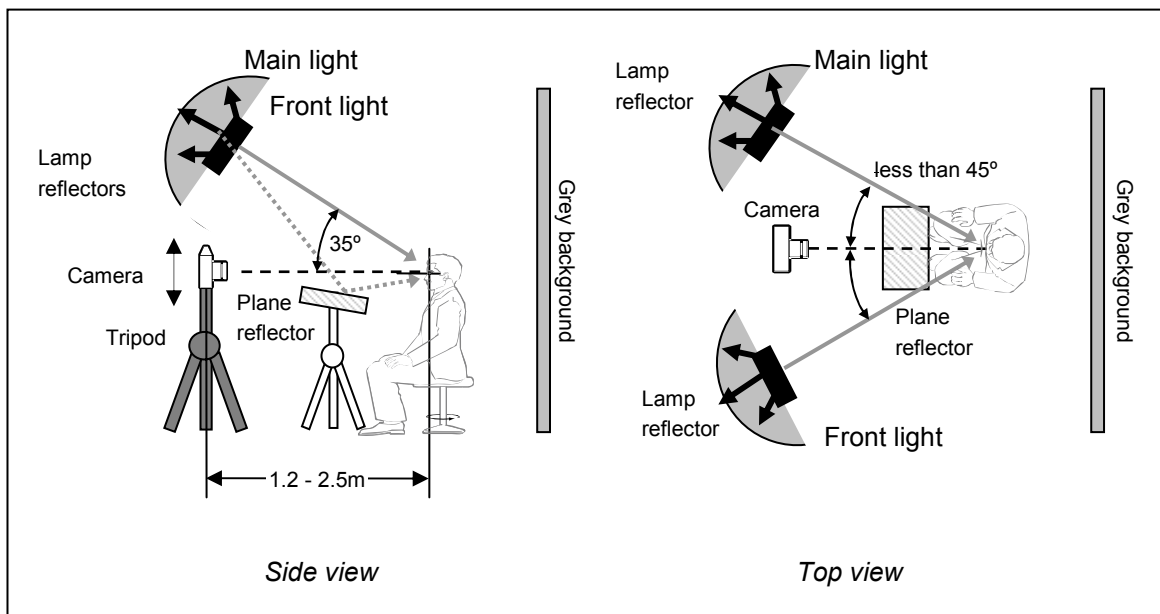


Figure B.5 — Lighting arrangement for a photo studio with dual front lights

B.2.1.3.3 Example 3: Proper lighting with dual lights and background lighting

The use of a background light added to the arrangement shown previously in Example 2 should eliminate shadows visible on the background behind the face. As illustrated in Figure B.6, the background light should be aimed at the background and be placed directly behind and below the subject.

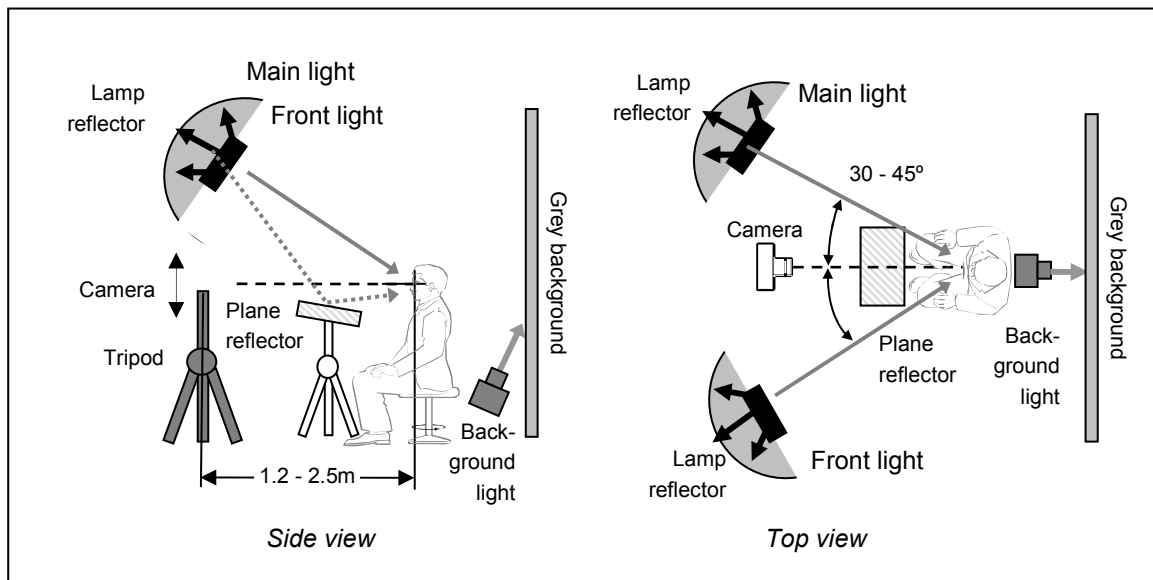


Figure B.6 — Lighting arrangement for a photo studio with dual front lights and a background light

B.2.2 Recommendations for photo booths

A photo booth is typically a coin-operated, self-portrait photography unit, mostly used for taking ID pictures and equipped with such tools as a camera, lighting, stool, plain background, printing device and monitoring screen, and sometimes including an audio self-guidance application. Optimizing photographic technology enabled its space-saving size, which has contributed to its widespread use around the world. Following are some guidelines for the design and operation of such photo booths. Front, side, and top views of the arrangements described in the guidelines are provided. Also provided in this clause are suggestions for camera and subject positioning and a description of methods to provide feedback to the subject concerning his or her pose and expression.

B.2.2.1 Proper lighting

- Position multiple lights behind a diffuser panel and symmetrically above the camera. This will provide even lighting on the subject's face and eliminate most glare and shadow problems. Place a background light low and midway between the background and the subject.
- The placement of the front lights 35 degrees above the line between the camera and the subject's head prevents direct reflection of the flash from a subject's glasses.
- The inside walls should be white, except directly behind the subject. The white walls serve as reflectors and ensure that lighting on the face is uniform horizontally and vertically.
- The interior lights of the booth should be left on during operation. This will usually eliminate red-eye problems associated with photography in dim light.
- To eliminate unwanted shadows around the chin caused by lights above the subject, direct or indirect lighting from below and in front of the subject should be used.
- To ensure that the booth is free from the effects of external light, an opaque curtain should be employed.